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Ab initio many-body calculations of light ion reactions

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The *ab initio* no core shell model/resonating group method (NCSM/RGM) introduced in Refs. [1, 2] is a promising technique capable of describing both structure and reactions in light nuclear systems. This approach combines a microscopic cluster technique with the use of realistic inter-nucleon interactions and a consistent microscopic description of the nucleon clusters.

The method has been introduced in detail for two-body clusters and has been shown to work efficiently in different systems [1, 2, 3, 4]. In this work we discuss recent advances of the method which include its coupling with the NCSM into a new approach called no core shell model with continuum (NCSMC) with results for ^{7}He resonances [5]. We also present the first results after the inclusion of three-nucleon forces in the calculations and its effect in the nucleon-^{4}He scattering phase shifts [6]. Finally, we introduce three-body cluster configurations and provide, for the first time within an *ab initio* framework, the correct asymptotic behaviour for the three-cluster wave functions. We present the results obtained for ^{6}He within a ^{4}He(g.s.)+n+n basis for the ground and continuum states [7].

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